# Optimizing N Fertilizer Rates For Seed Yield in *Camelina sativa* and *Brassica carinata*

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## Introduction

- Camelina (*Camelina sativa* [L.] Crantz) is a new crop to western Canada, with potential applications in cosmetics, human nutrition and biofuel, and is being promoted as a low-input crop. It appears to more drought tolerant than other *Brassica* oilseed crops.
- Carinata (*Brassica carinata* L.), also called Ethiopian mustard, is an oil producing *Brassica* species with potential applications in lubricants, biopesticides and fish feed.
- The nitrogen (N) requirements to optimize yield of both camelina and *Brassica carinata* L. on the Canadian Prairies are not known.

## Objectives

**The objective of the study is to determine Optimum N fertilizer requirements for:**

- Seed yield
- Seed quality
- N uptake,
- N use efficiency (NUE – seed yield in kg $ha^{-1}$ produced per unit of N supply)
- N fertilizer use efficiency (NFUE – seed yield in kg $ha^{-1}$ produced per unit fertilizer N)
- N utilization efficiency (NUTE – seed yield in kg $ha^{-1}$ produced per unit of N derived from soil without fertilizer N).

This report only contains information on optimum N requirements for Seed yield

## Materials and Methods

- Field experiments were conducted at Scott, Melfort, Lethbridge (University of Alberta) and Swift Current (Wheatlands Conservation Area Inc.) in 2008; at Scott, Melfort, Lethbridge and Indian Head (camelina only) in 2009 and 2010.

- The adverse weather in 2010 resulted in losing both trials at Lethbridge and the camelina trial at Melfort.
- In 2008, two different experiments were set up.
- In Experiment 1, rates of 0, 40, 80, 120 and 160 kg N $ha^{-1}$ were applied to camelina and *B. carinata*.
- Experimental design was a split-plot with crop type being the main plot and N rate being the sub-plot.
- Experiment 2 was conducted at Scott only, with rates of 0, 25, 50, 75, 100, 125, and 150 kg N $ha^{-1}$.
- The N treatments were applied in a RCBD design to camelina and *B. carinata* in separate experiments.
- In 2009 and 2010 in Experiment 2, the rates of 0, 25, 50, 75, 100,125, 150 and 200 kg N $ha^{-1}$ were applied in a RCBD design to camelina and *B. carinata* in separate experiments.
- Data were collected on seed and straw yield, total N concentration in seed and straw to calculate protein concentration in seed (seed quality) and N uptake in seed and straw, and oil concentration in seed for seed quality.
- The data for seed yield were analyzed with PROC Mixed and a quadratic plateau response model was used to describe the response.
- The model calculates a join point, which is basically the N rate at which yields reach a plateau.

## Summary

### *Camelina sativa*

- In Experiment 1, camelina responded to N rates considerably and seed yields began to level off at 116 kg N $ha^{-1}$, which is the join point (Figure 1). Seed yield reached a plateau of 2035 kg $ha^{-1}$.
- In Experiment 2, there was also a substantial seed yield response to applied N and a yield plateau of 1915 kg $ha^{-1}$ was achieved at a rate of 95 kg N $ha^{-1}$ (Figure 2).

### *Brassica carinata*

- In Experiment 1, *B. carinata* responded to N rates dramatically and seed yields began to level off at 108 kg N $ha^{-1}$ (Figure 3). Seed yield reached a plateau of 2158 kg $ha^{-1}$.
- In Experiment 2, a seed yield plateau of 1685 kg $ha^{-1}$ was achieved at a rate of 135 kg N $ha^{-1}$ (Figure 4).
- Previous studies by Gan et al. (2007) have shown that other *Brassica* crops reached a plateau at about 100 kg N $ha^{-1}$.

- These studies indicate that respective N requirements for camelina and *B. carinata* are similar to and slightly higher than *Brassica napus* canola, *Sinapis alba*, and *Brassica juncea*, depending on the soil climatic zone.

## Conclusion

- Seed yields of camelina were consistent over years with seed yields reaching a plateau at N application rates of 95 to 108 kg $ha^{-1}$.
- *B. carinata* was a bit more inconsistent with seed yields reaching a plateau at N application rates of 108 to 135 kg $ha^{-1}$.

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***Camelina sativa* studies**

- Prairie-Wide Canola Agronomy Research Agreement,
- Canola Council of Canada,
- Alberta Canola Producers Commission,
- Saskatchewan Canola Development Commission,
- Manitoba Canola Growers Commission.

***Brassica carinata* studies**

- Saskatchewan Agriculture Development Fund,
- Saskatchewan Ministry of Agriculture ADF Project #20070130.

***Camelina sativa***

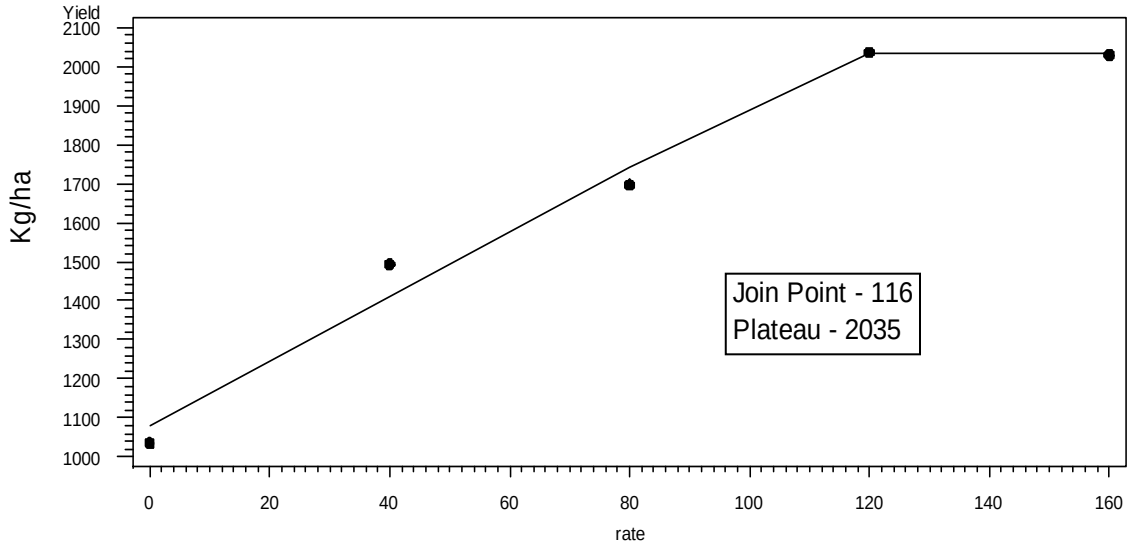


Figure 1. Seed yield response of *Camelina sativa* to N rate (average of 4 locations in Saskatchewan and Alberta in Experiment 1) in 2008.

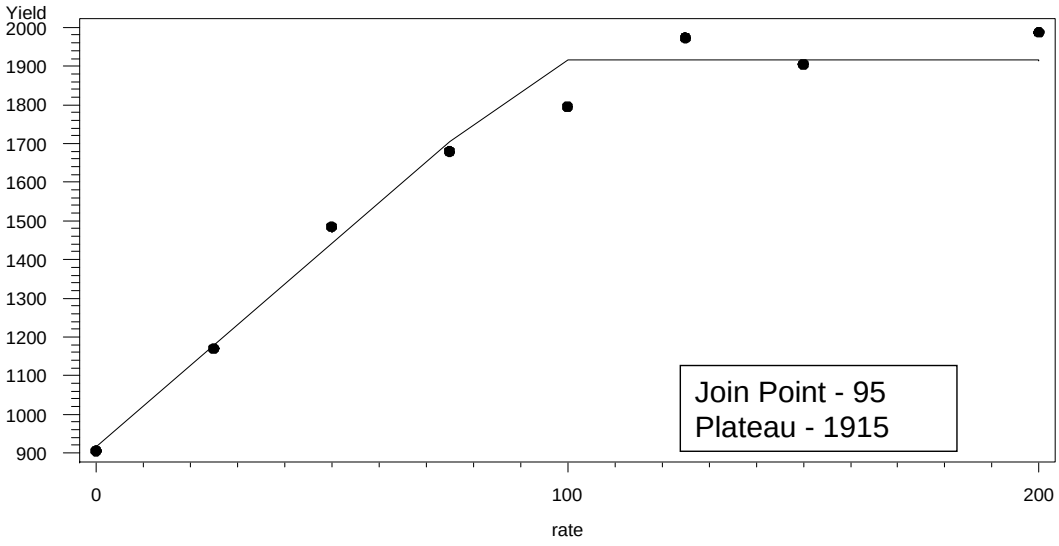


Figure 2. Seed yield response of *Camelina sativa* to N rate (average of 7 locations in Saskatchewan and Alberta in Experiment 2) in 2008 (one location), 2009 (four locations) and 2010 (two locations).

***Brassica carinata***

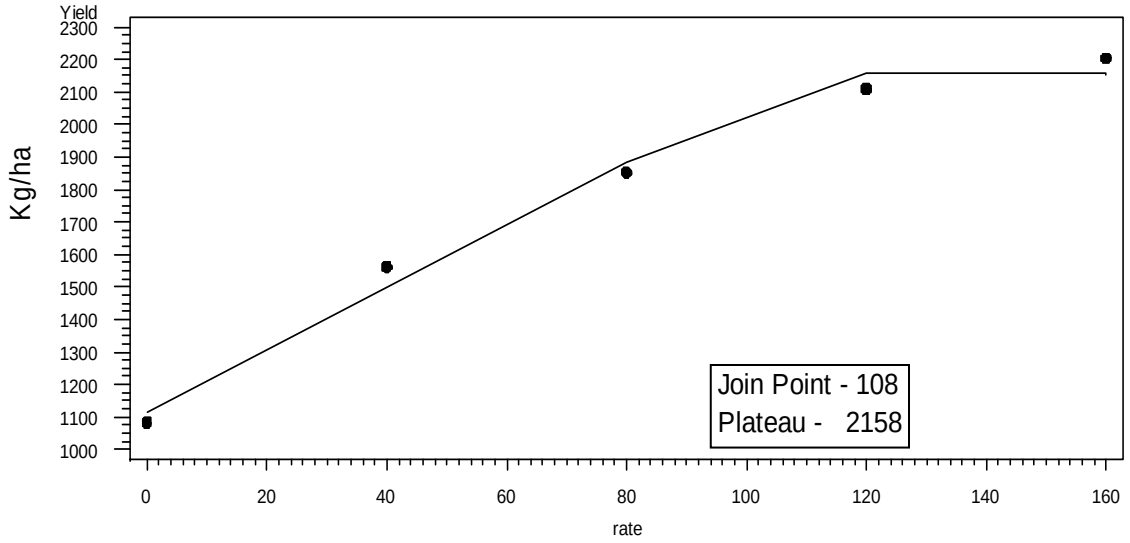


Figure 3. Seed yield response of *Brassica carinata* to N rate (average of 4 locations in Saskatchewan and Alberta in Experiment 1) in 2008.

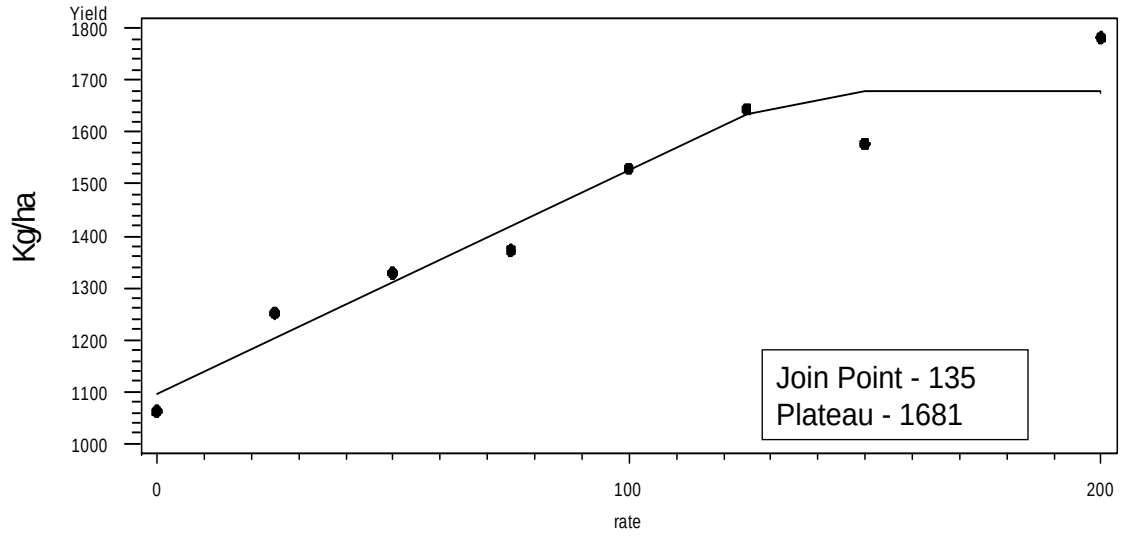


Figure 4. Seed yield response of *Brassica carinata* to N rate (average of 7 locations in Saskatchewan and Alberta in Experiment 2) in 2008 (one location), 2009 (four locations) and 2010 (2 locations).